

Fig.1

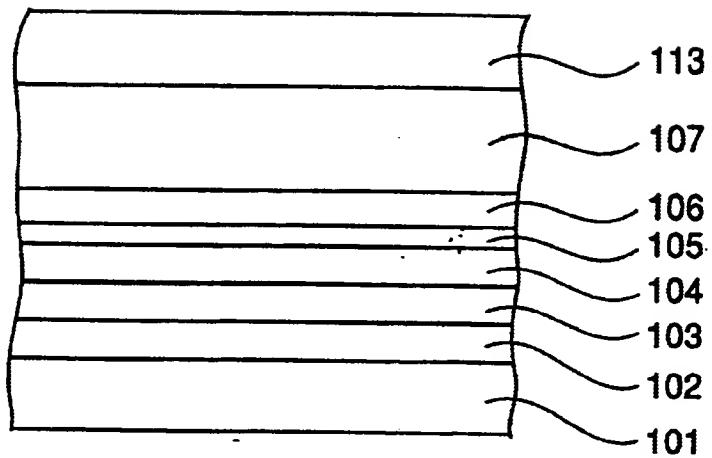


Fig.2

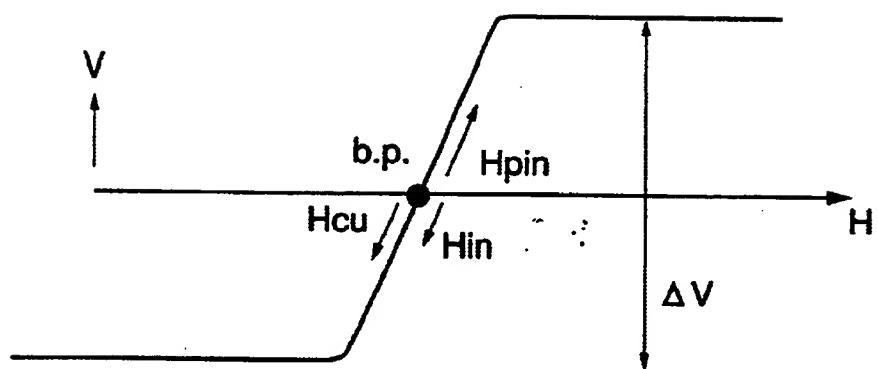


Fig.3

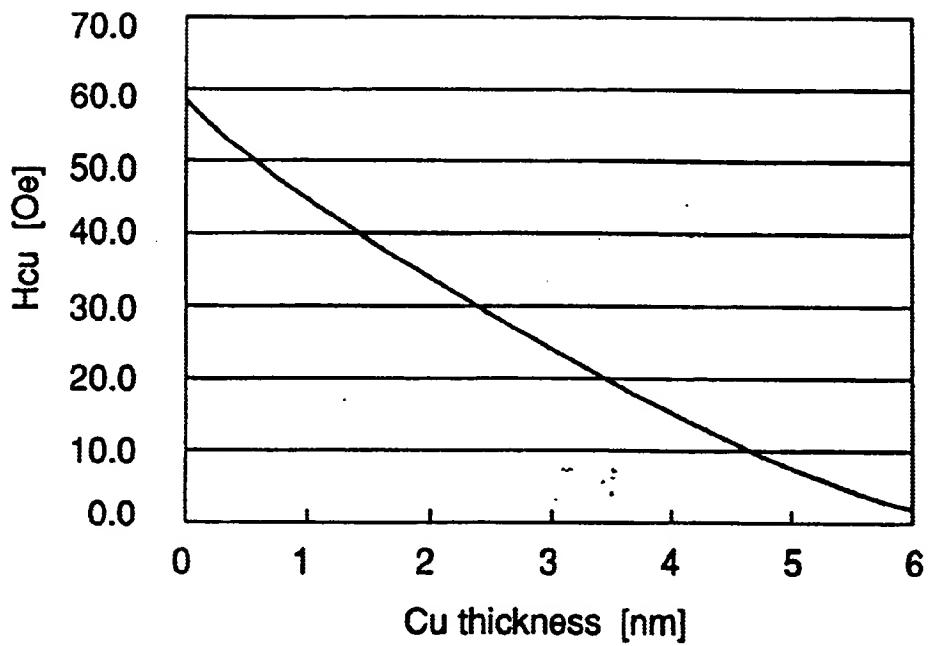


Fig.4

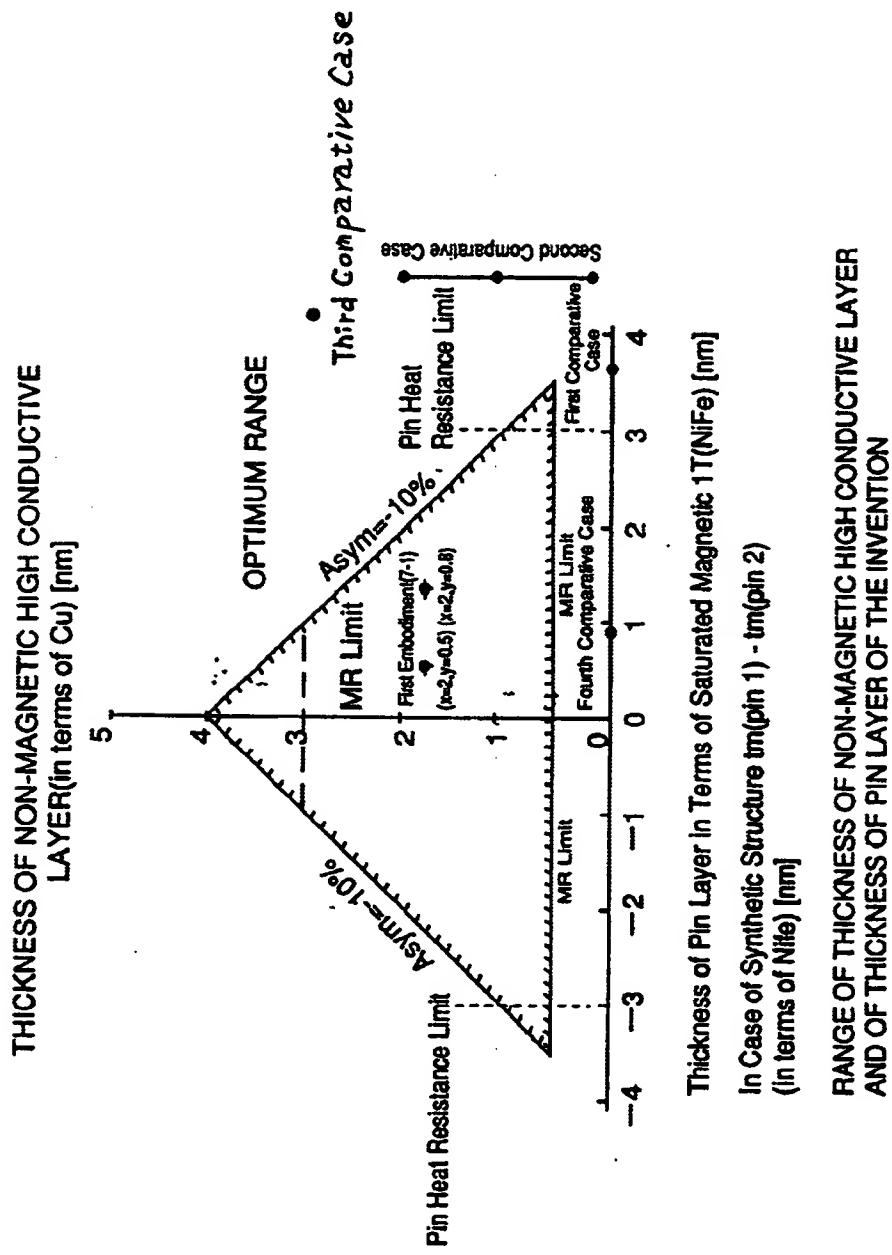
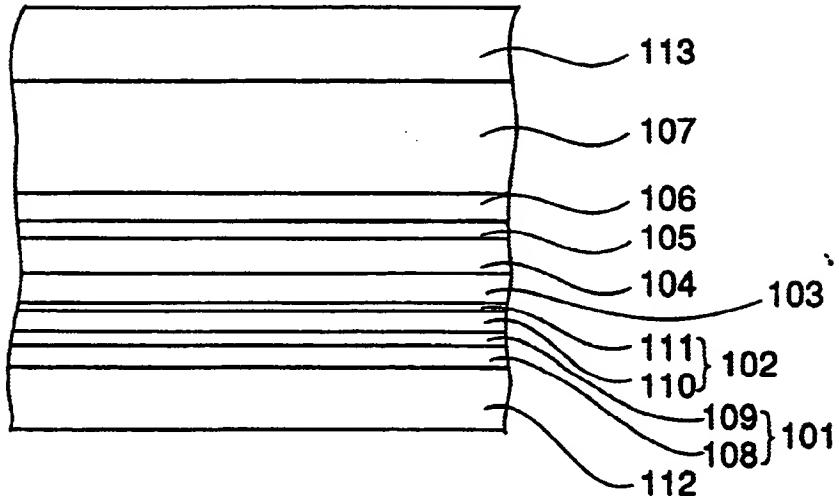
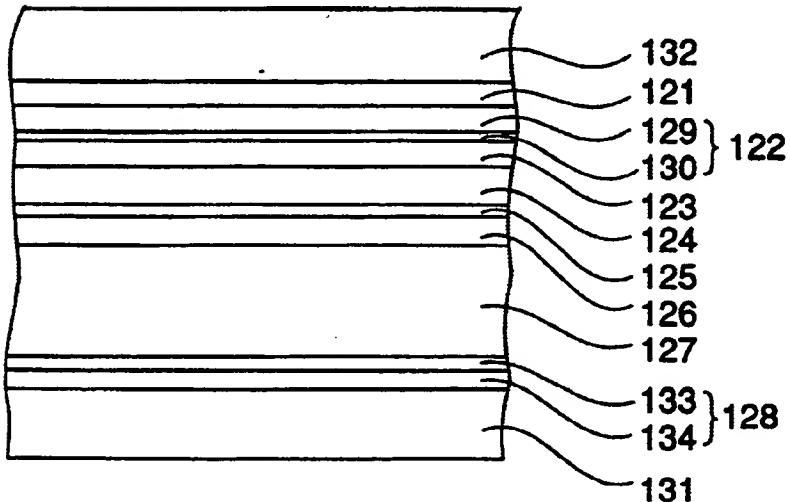


Fig.5



EMBODIMENT IN TOP TYPE

Fig.6



EMBODIMENT IN BOTTOM P TYPE

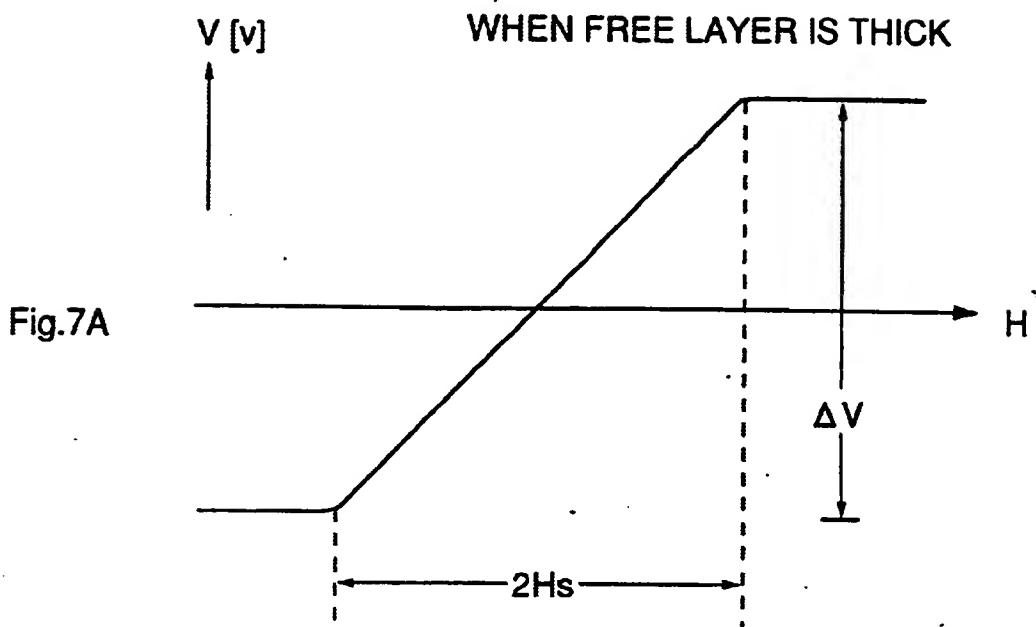


Fig.7A

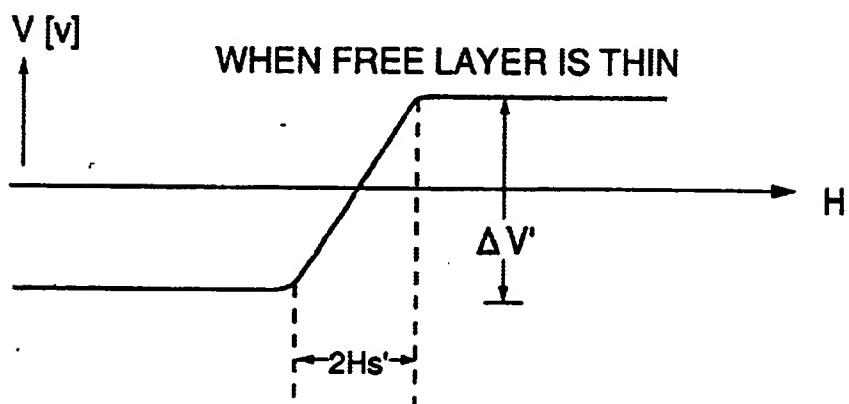


Fig.7B

PROBLEMS WHEN FREE LAYER IS THIN:

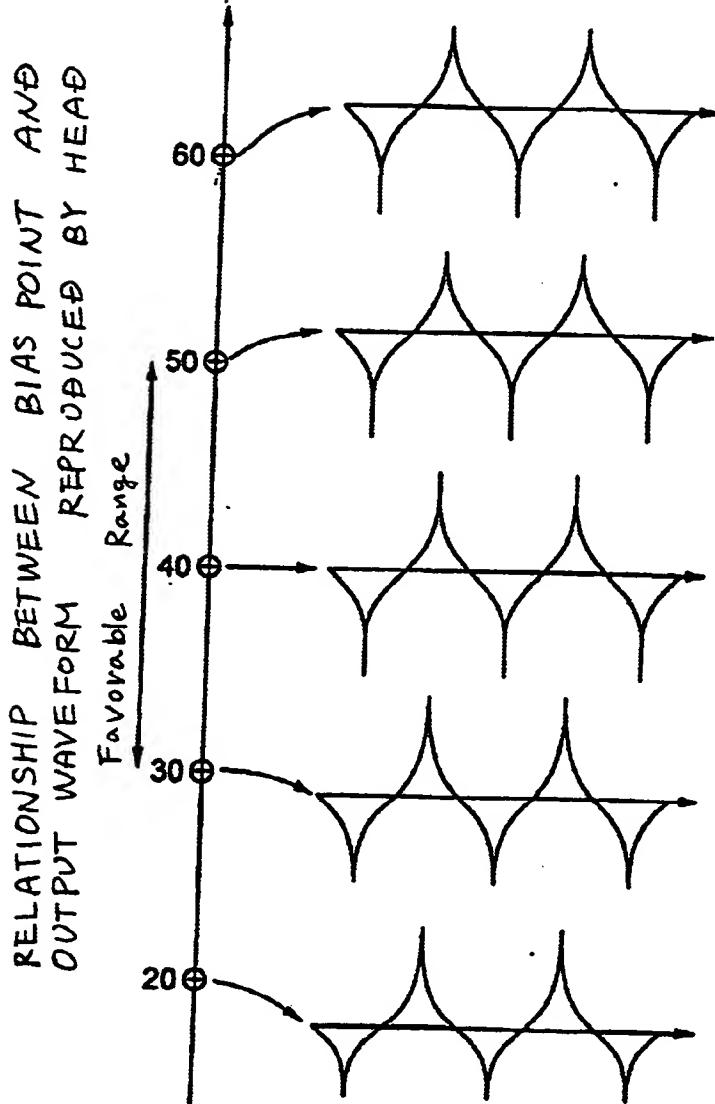
Hs' < Hs (Inclination becomes sharp)

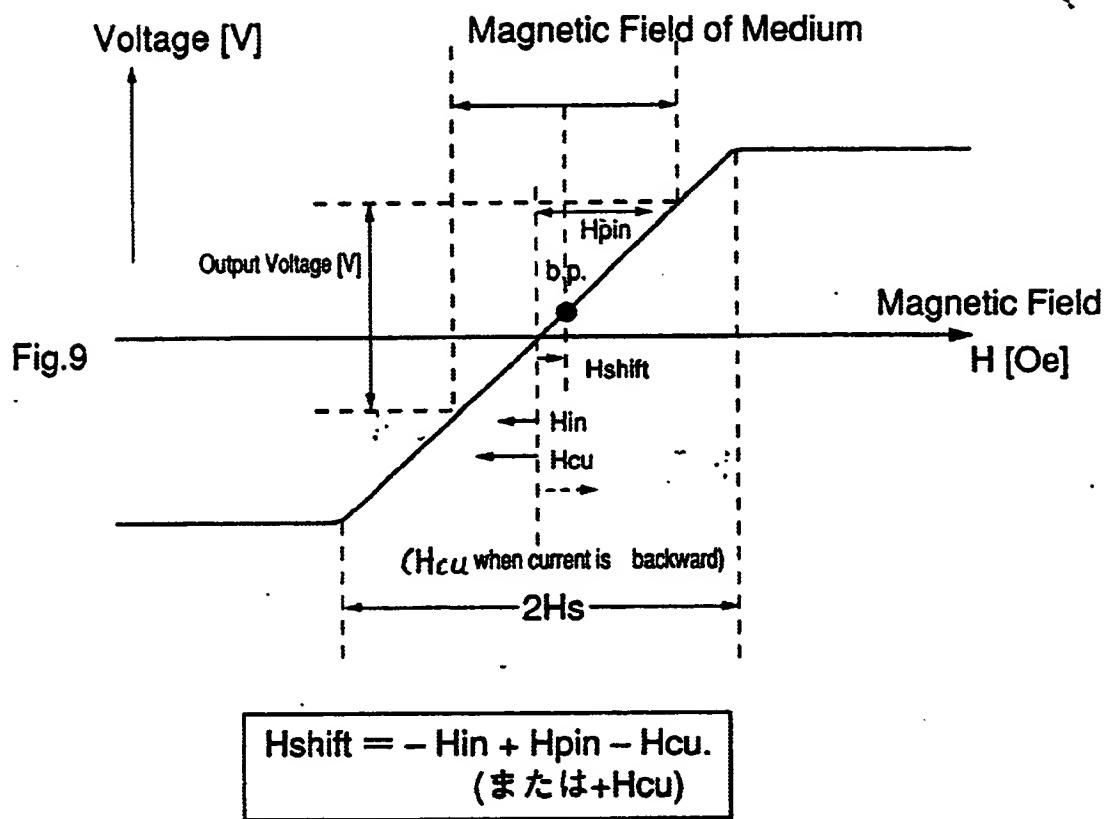
→ Hard to adjust bias point

- $\Delta V' < \Delta V$ (HR ratio decreases)

→ Cannot produce output signal

BIAS POINT IN CALCULATION [%]

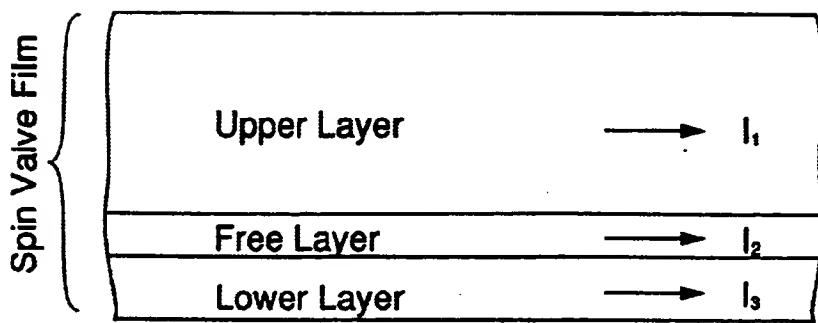




CONCEPTUAL GRAPH BIAS POINT (b.p.)
INDICATED ON TRANSFER CURVE

PRINTED ON A SENSE SENSE SENSE

Fig.10



Sense Current : $I_s = I_1 + I_2 + I_3$ [mA]

DIAGRAMMATIC VIEW OF DIVIDED CURRENT FLOWS
OF SPIN VALVE FILM

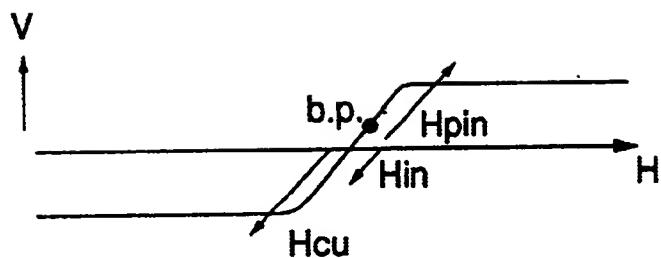
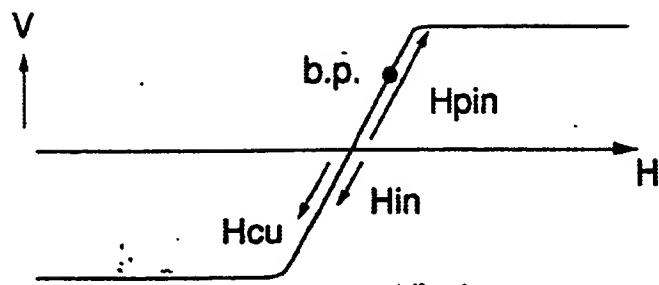


Fig.11

BIAS POINT OF FIRST COMPARATIVE CASE (No Spin Filter x
Normal Pin)

- (- Controllability becomes bad to bring large H_{pin} to
just bias by large H_{cu} (height dependency is large)
- Output drops because no Spin-Filter effect is utilized)

Fig.12



^{2nd}
BIAS POINT OF COMPARATIVE CASE (Spin Filter exists x Normal Pin)
(b.p. increases considerably more than 50% because Hpin is large and Hcu is small)

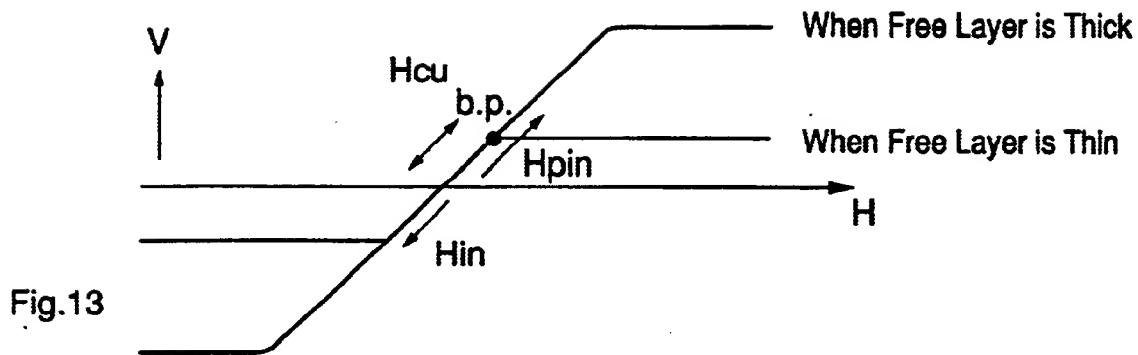


Fig.13

BIAS POINT OF THIRD COMPARATIVE CASE

(-Bias point is stabilized when free layer is thick just by decreasing H_{cu} .

-When free layer is thinned, influence of H_{pin} is large and b.p. deviates. MR also deteriorates)

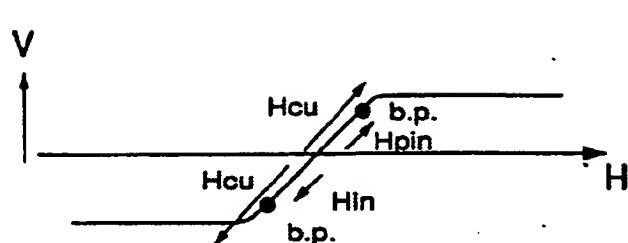


Fig.14

BIAS POINT OF FOURTH COMPARATIVE CASE (No Spin Filter x
Synthetic AF)

(-Just bias cannot be obtained even when current is
flown in either direction when H_{in} and H_{pin} are small and
 H_{cu} is large near the place where $-H_{in}+H_{pin}$ is almost 50%)

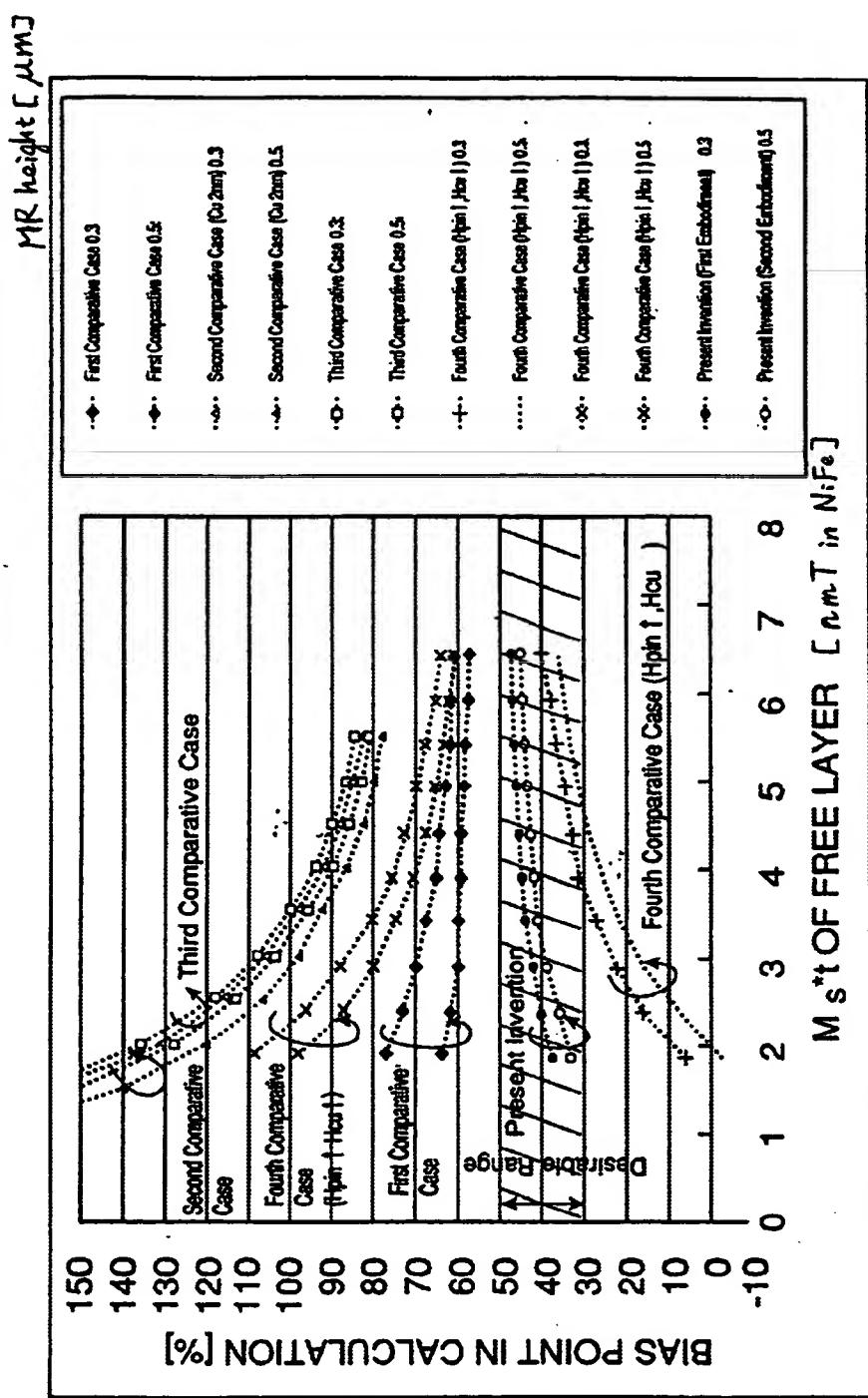
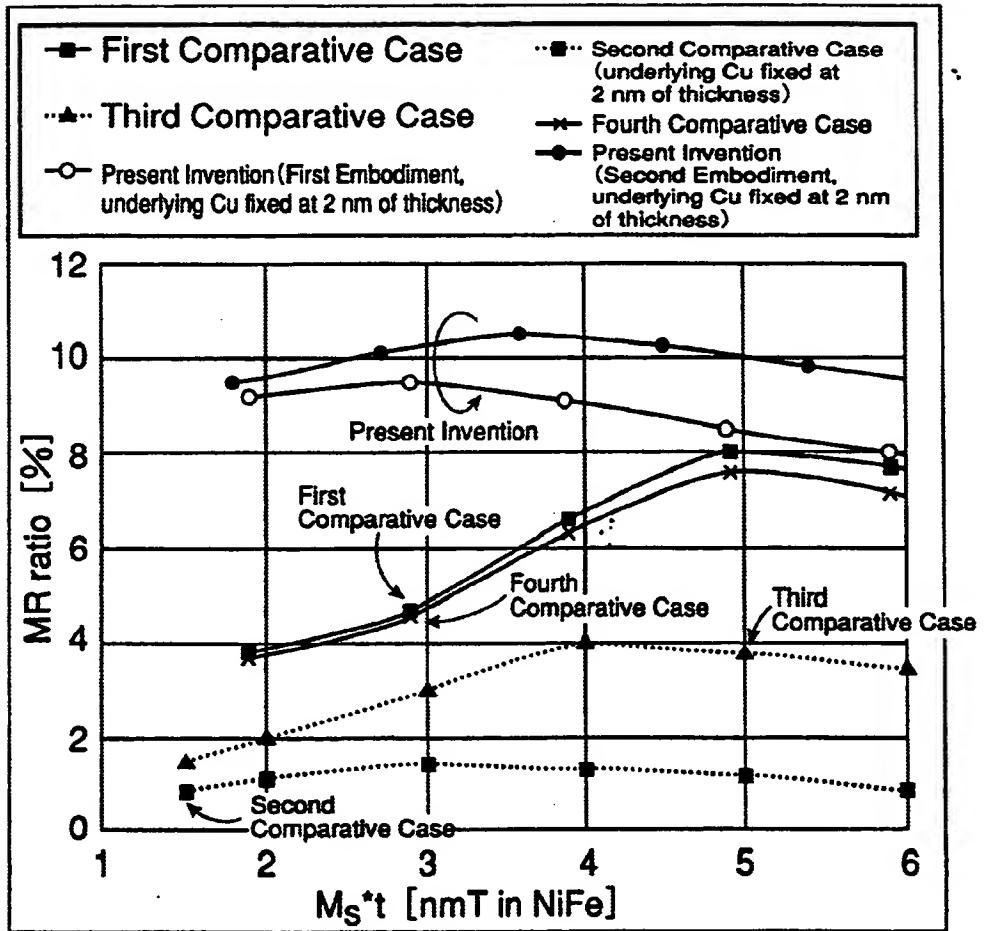
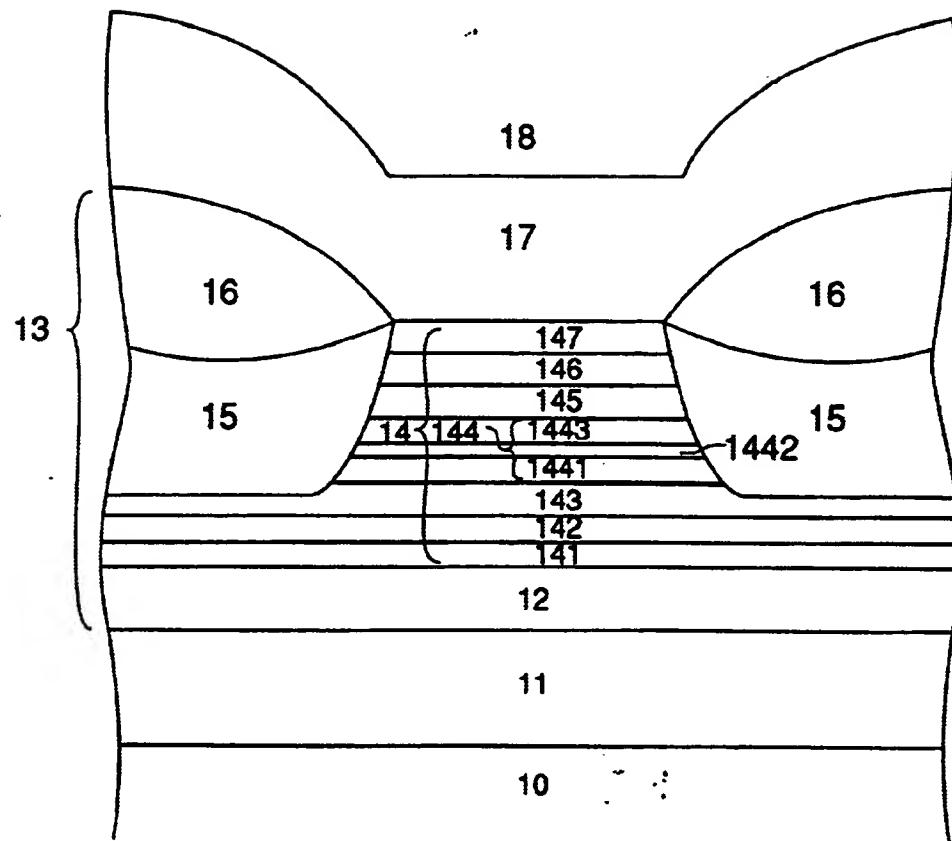


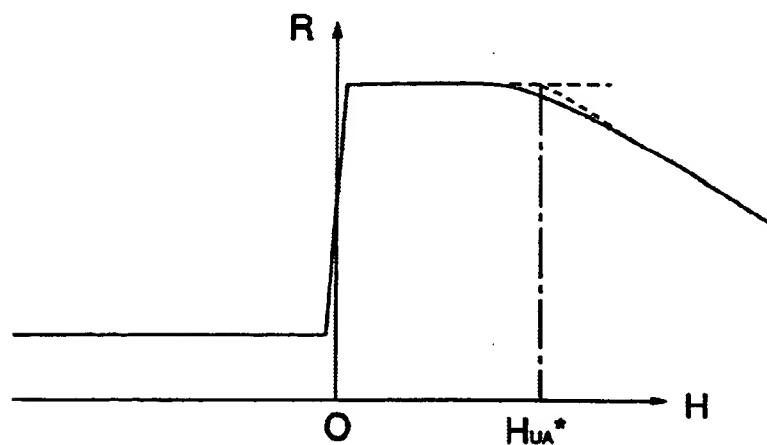
Fig.15

Fig.16





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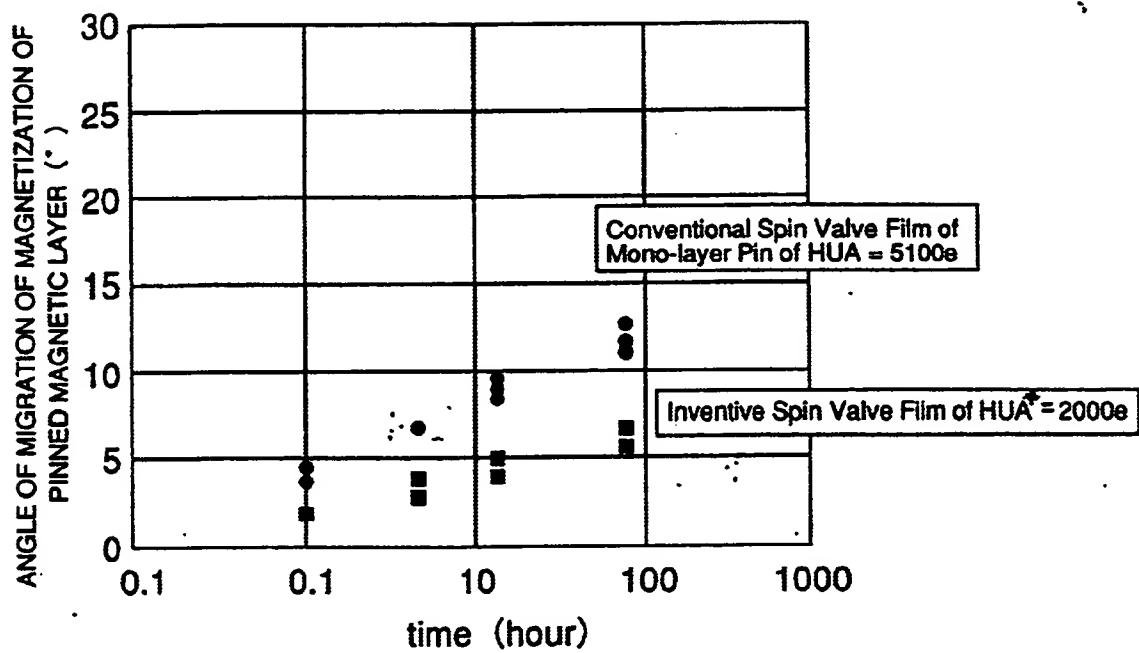
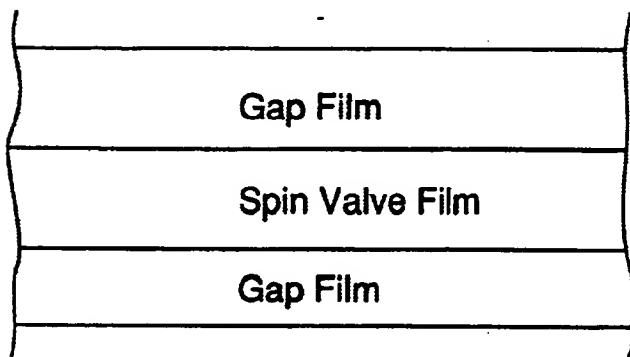
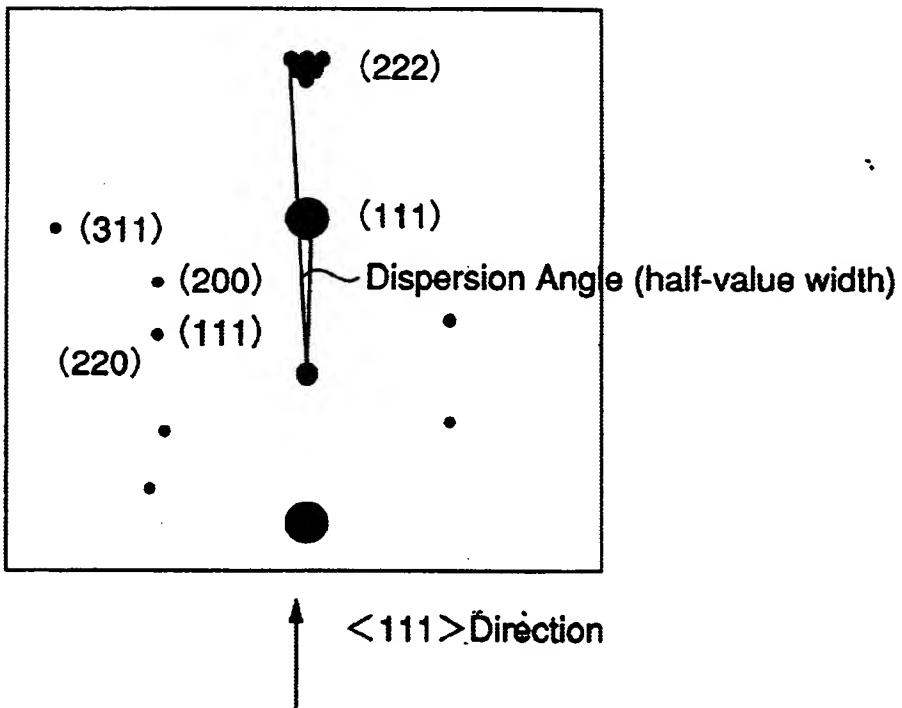


Fig.19

Fig.20

DIFFRACTION PATTERN



SECTIONAL VIEW OF SPIN VALVE ELEMENT PART

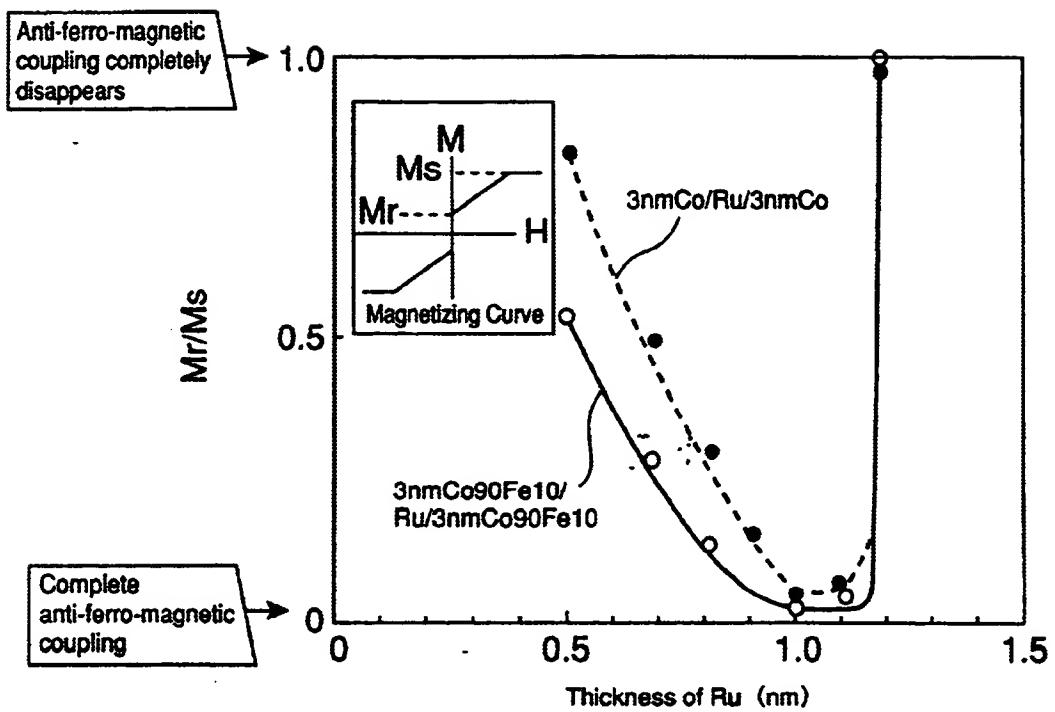


Fig.21

Fig.22A

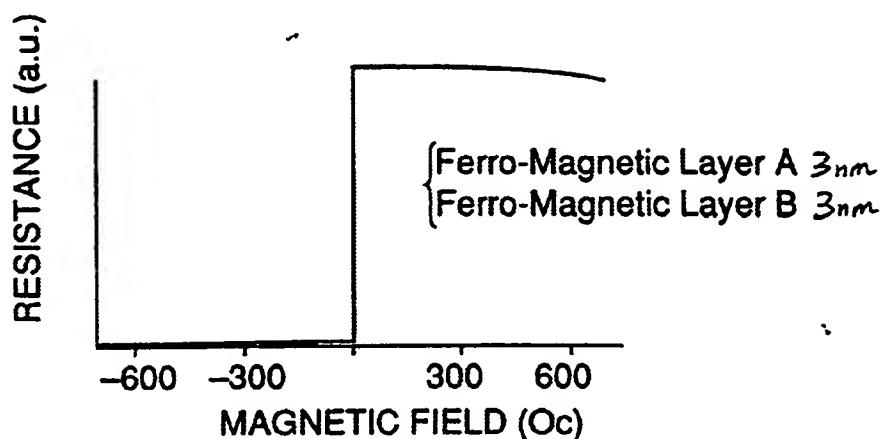


Fig.22B

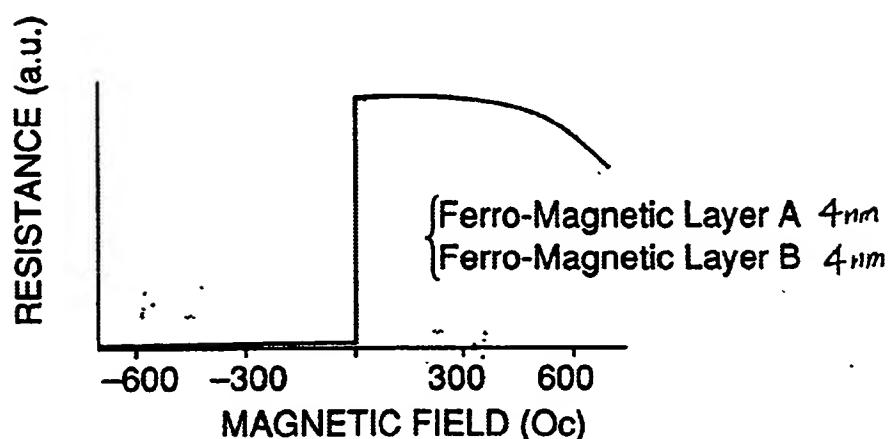


Fig.22C

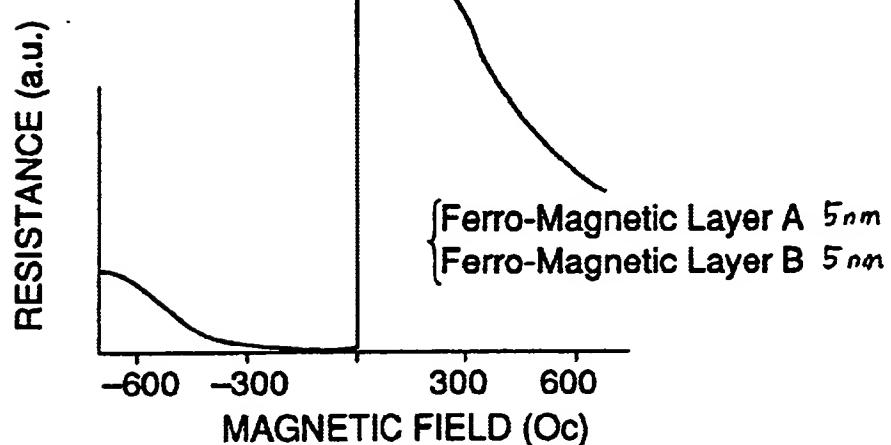


Fig.23A

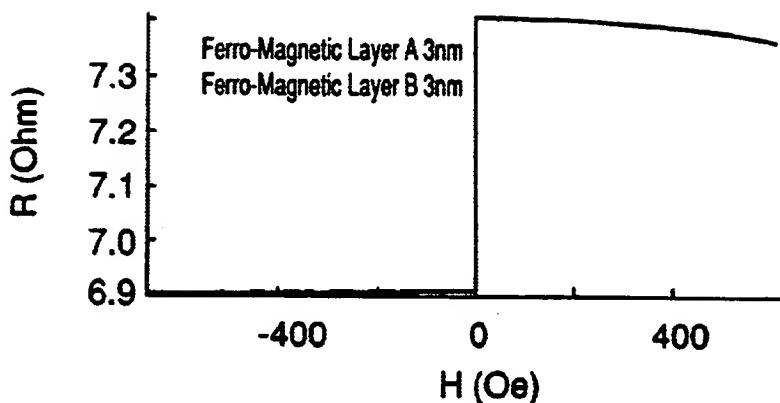


Fig.23B

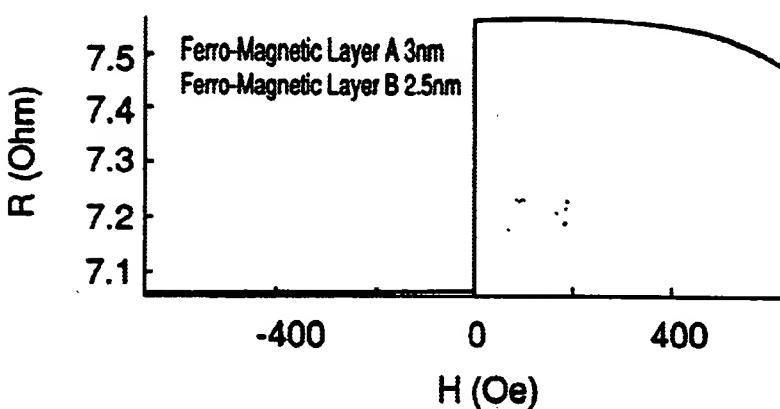


Fig.23C

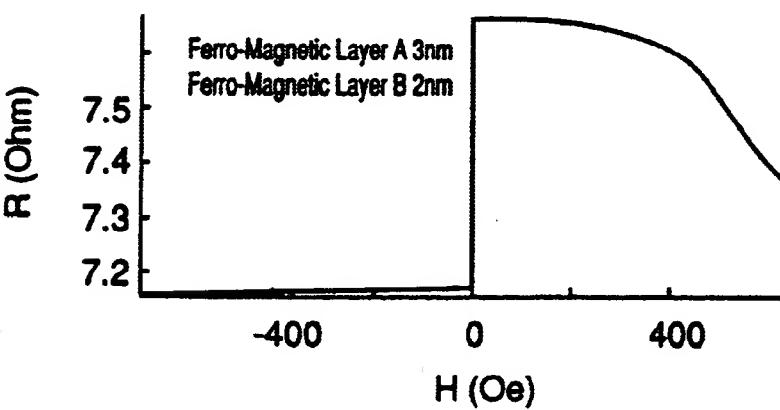


Fig.24A

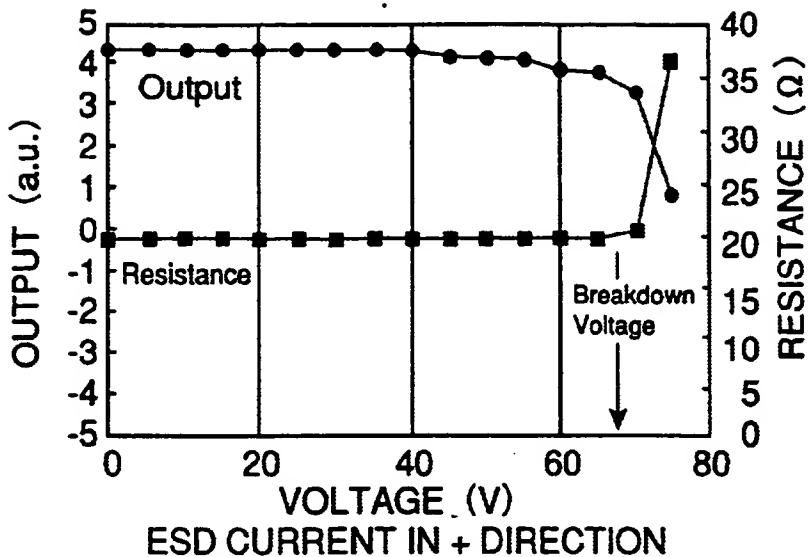
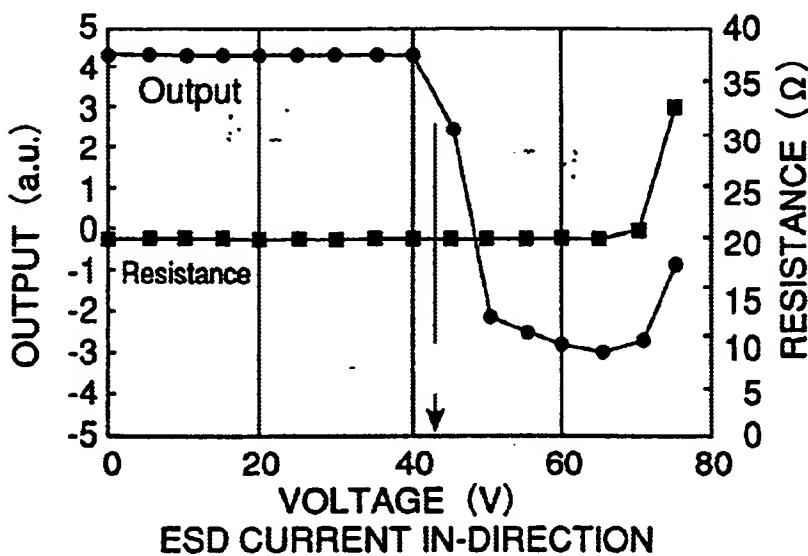


Fig.24B



STRUCTURE OF SV FILM

{ VOLTAGE : ESD Voltage by Human Body Model.
ESD CURRENT : + Direction is direction in which ESD Current
Magnetic Field is applied in the Same Direction with Magnetization
of Ferro-magnetic Layer B }

WHEN THICKNESS OF MAGNETIC LAYER OF
FERRO-MAGNETIC LAYER A IS EQUAL WITH THAT OF
FERRO-MAGNETIC LAYER B

Fig.25A

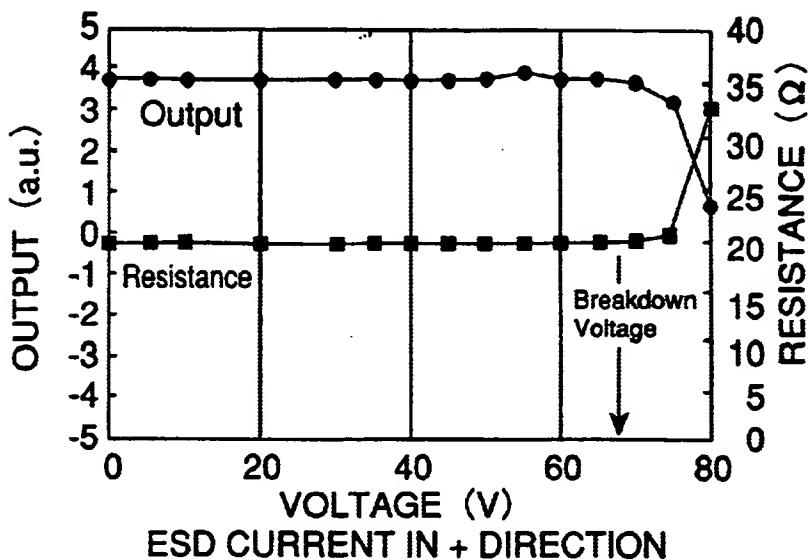
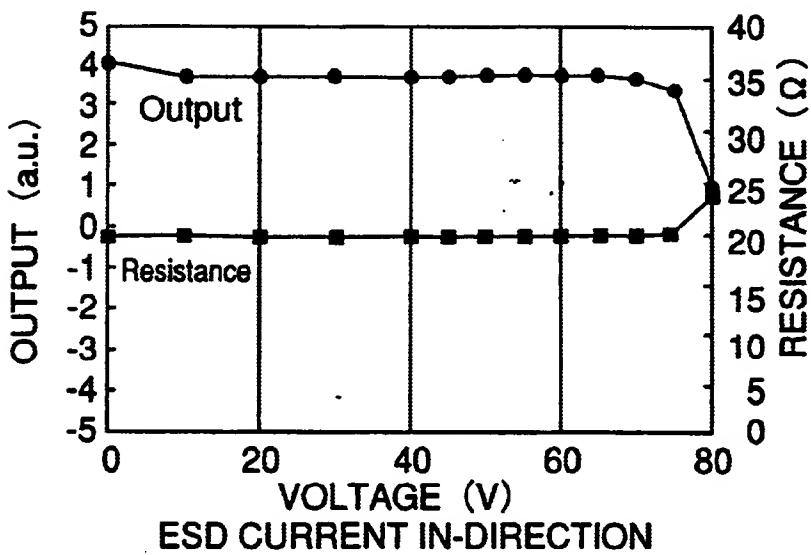


Fig.25B



STRUCTURE OF SV FILM

{ VOLTAGE : ESD Voltage by Human Body Model
ESD CURRENT : + Direction is direction in which ESD Current
Magnetic Field is applied in the Same Direction with Magnetization
of Ferro - magnetic Layer B }

WHEN THICKNESS OF MAGNETIC LAYER OF
FERRO-MAGNETIC LAYER A > THICKNESS OF MAGNETIC
LAYER OF FERRO-MAGNETIC LAYER B

Fig.26

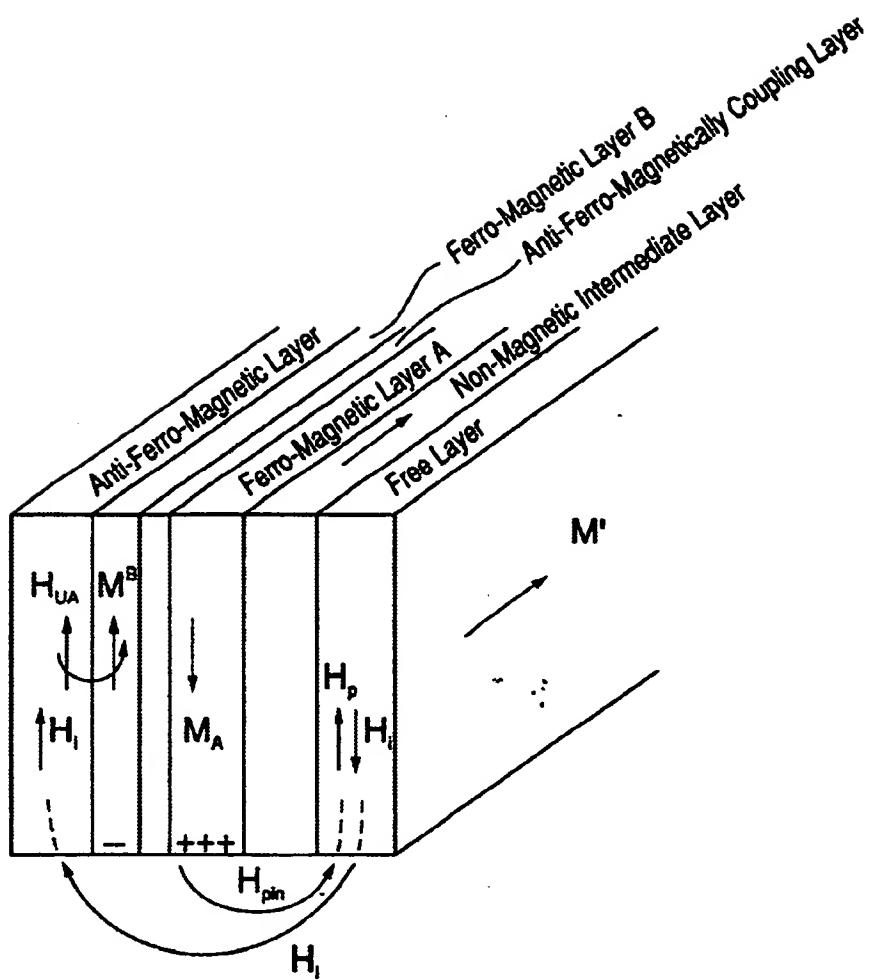


Fig.27

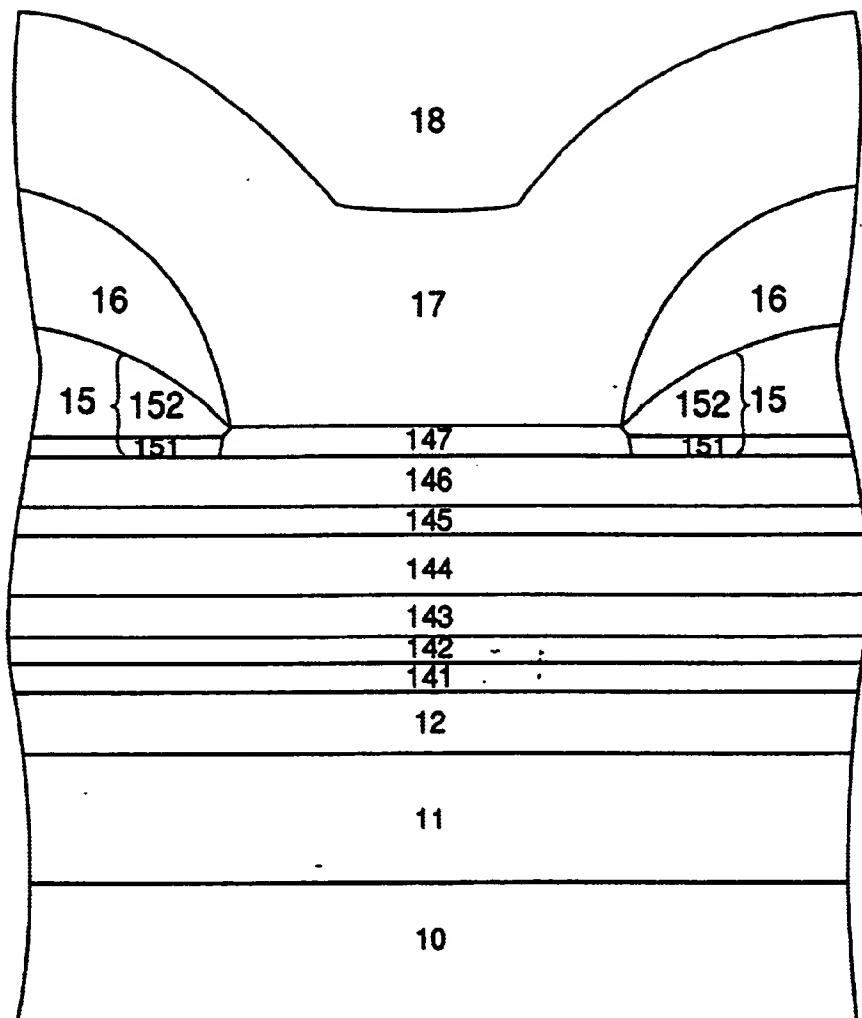


Fig.28

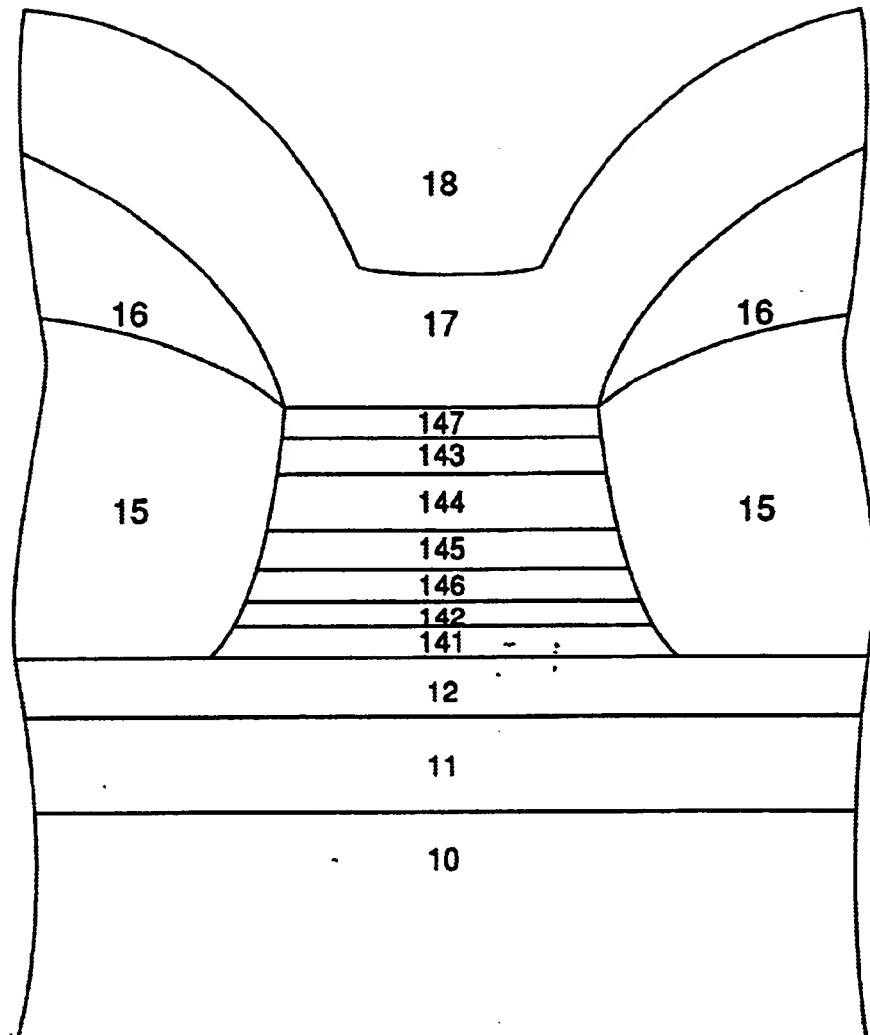


Fig.29

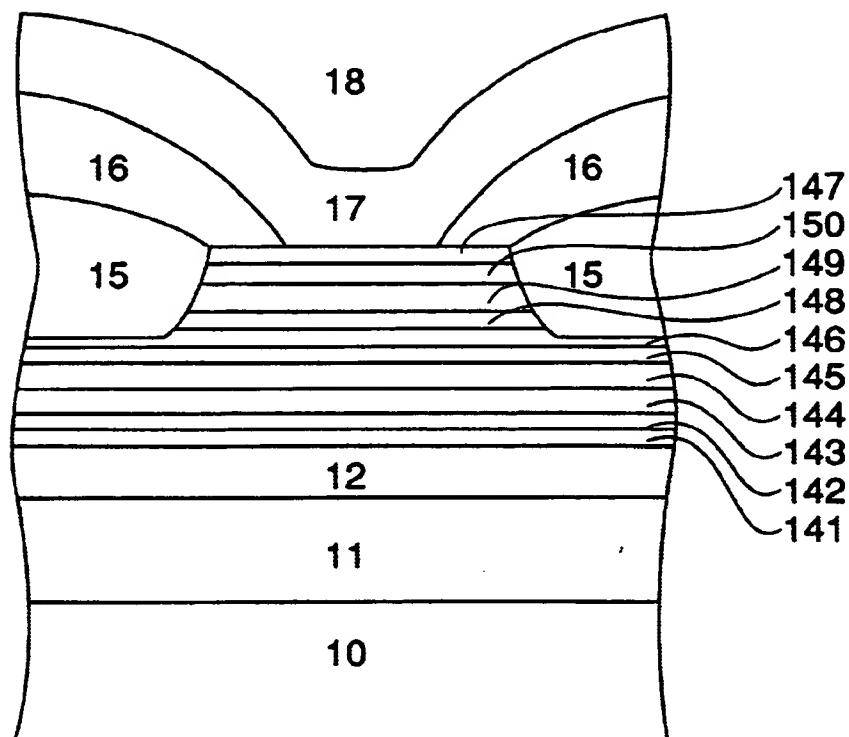


Fig.30

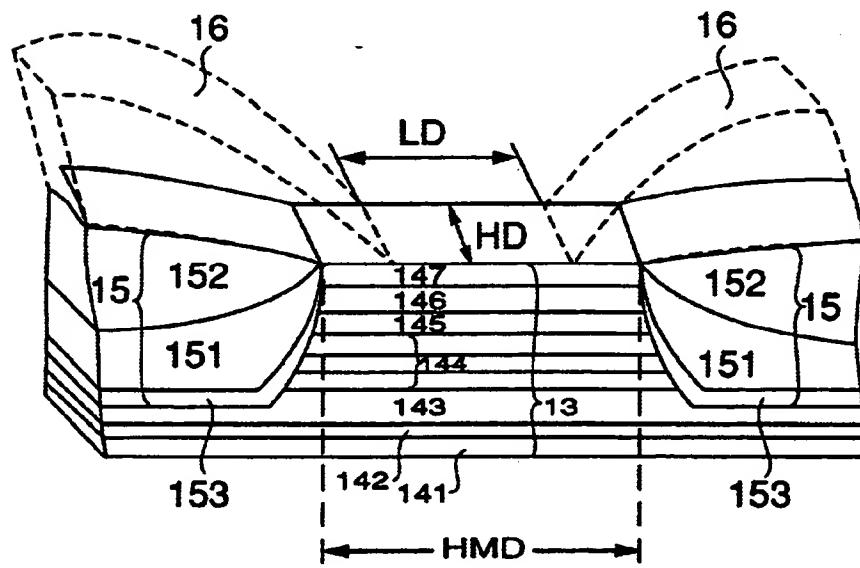


Fig.31

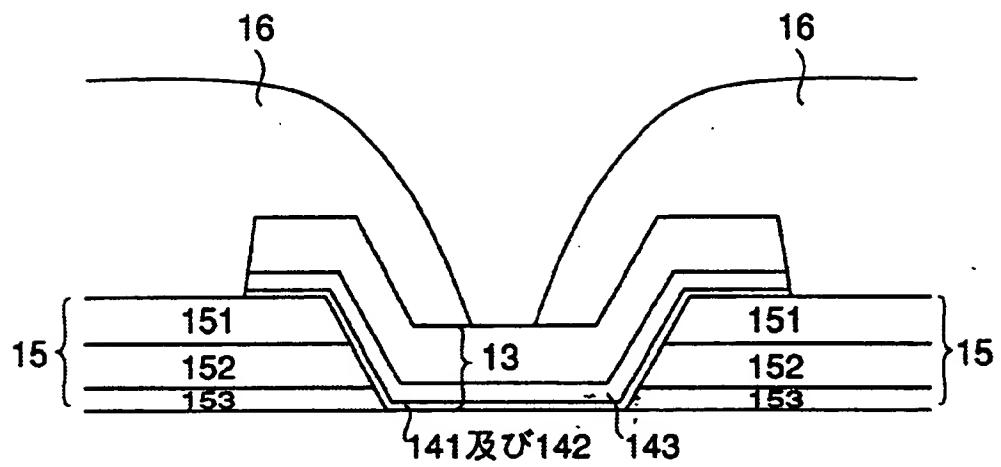


Fig.32

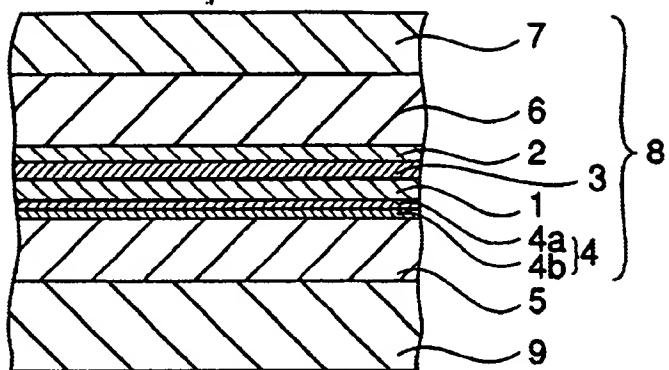


Fig.33

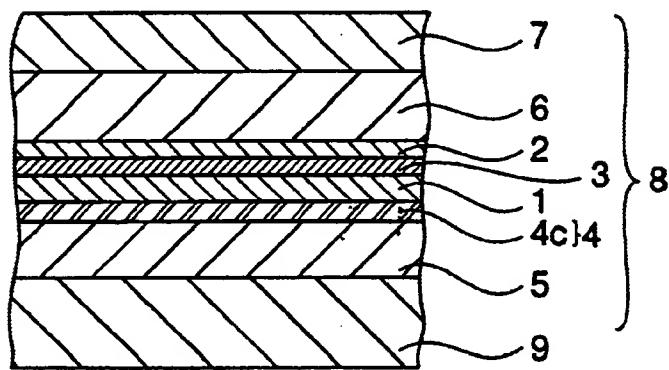


Fig.34

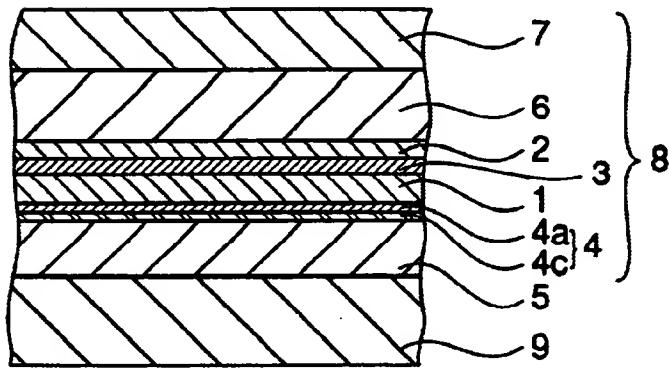


Fig.35A

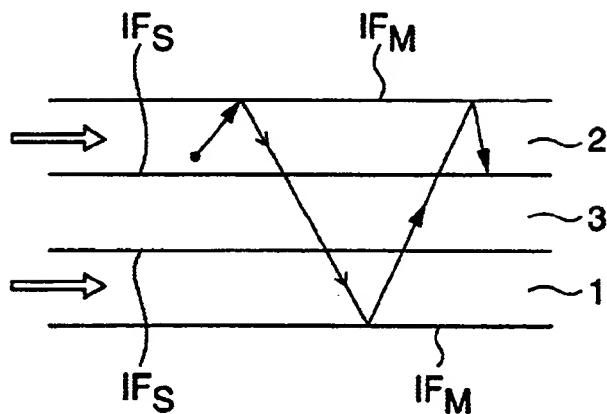


Fig.35B

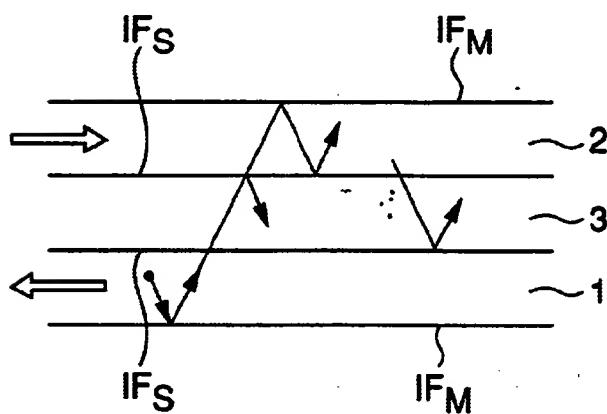


Fig.35C

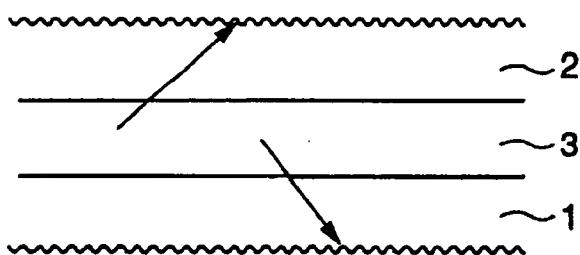


Fig.36

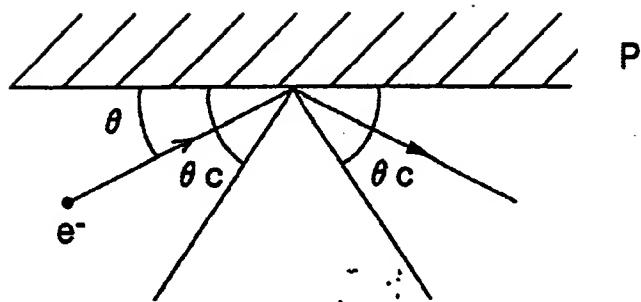


Fig.37A

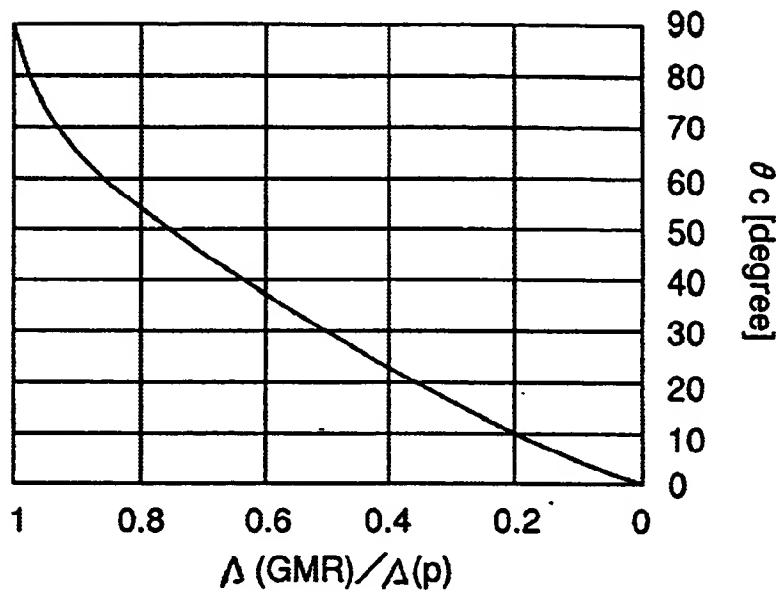


Fig.37B

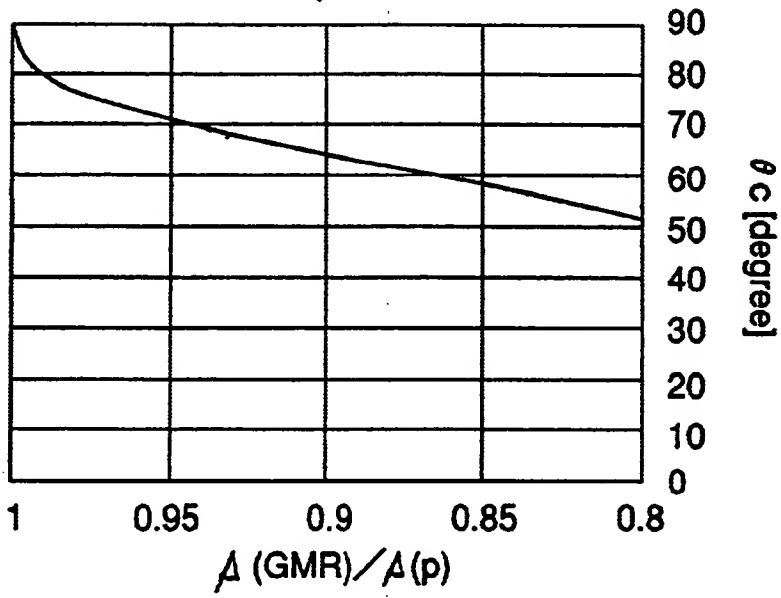


Fig.38

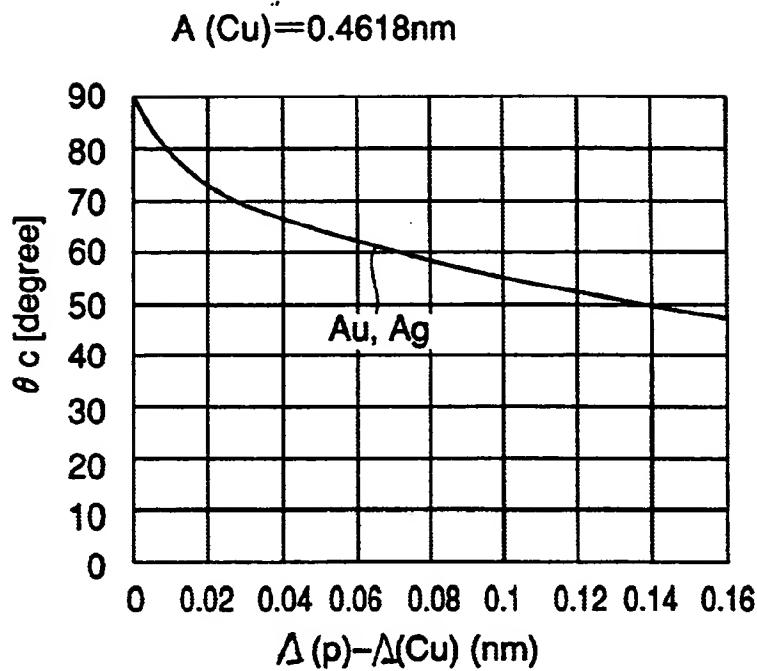
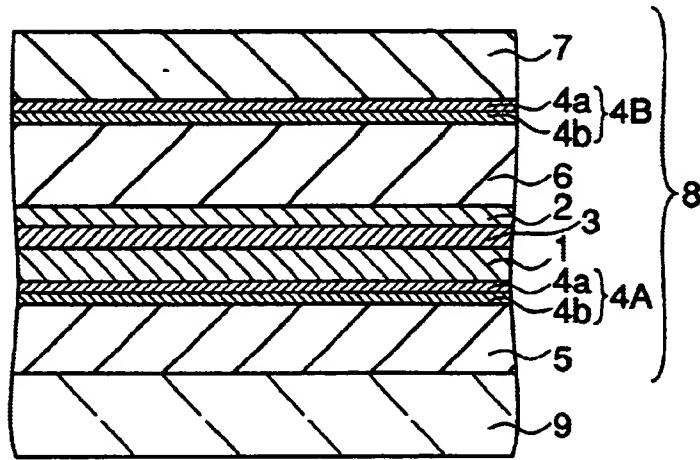


Fig.39



34/
43

Fig.40

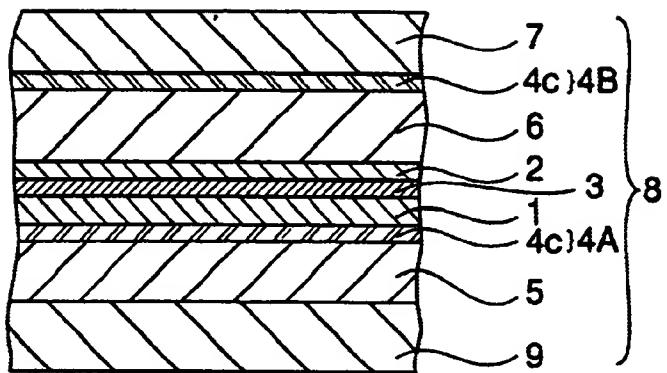


Fig.41

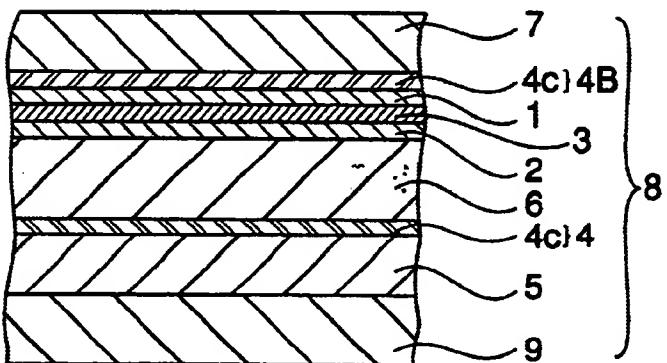
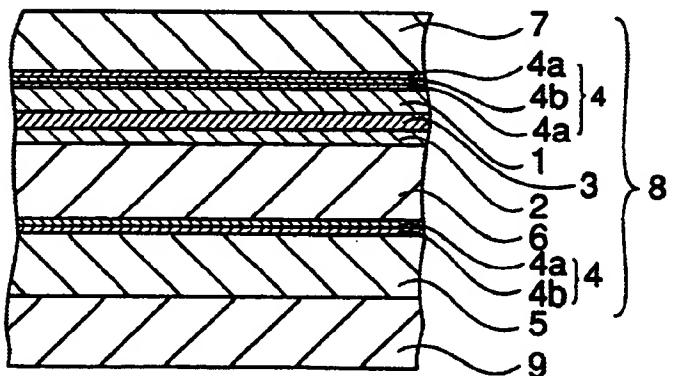


Fig.42



TOP TOP SECRET//NOFORN

Fig.43

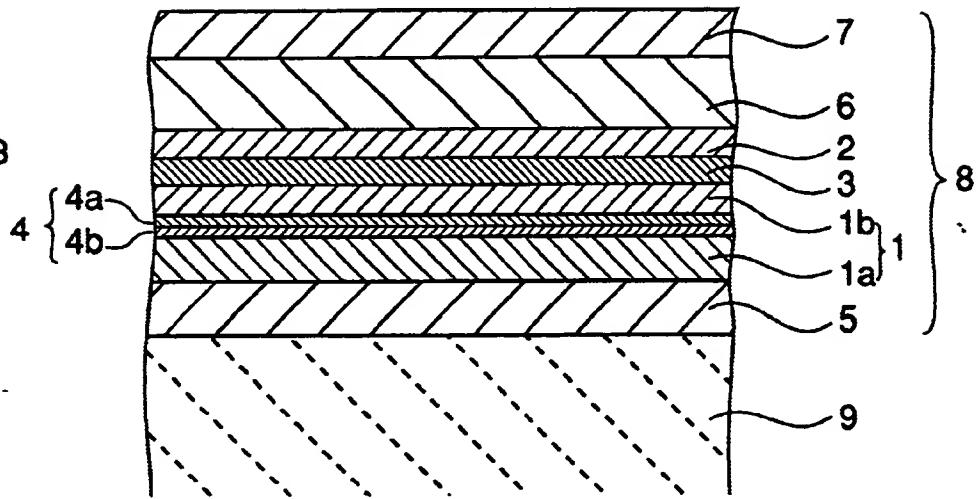


Fig.44

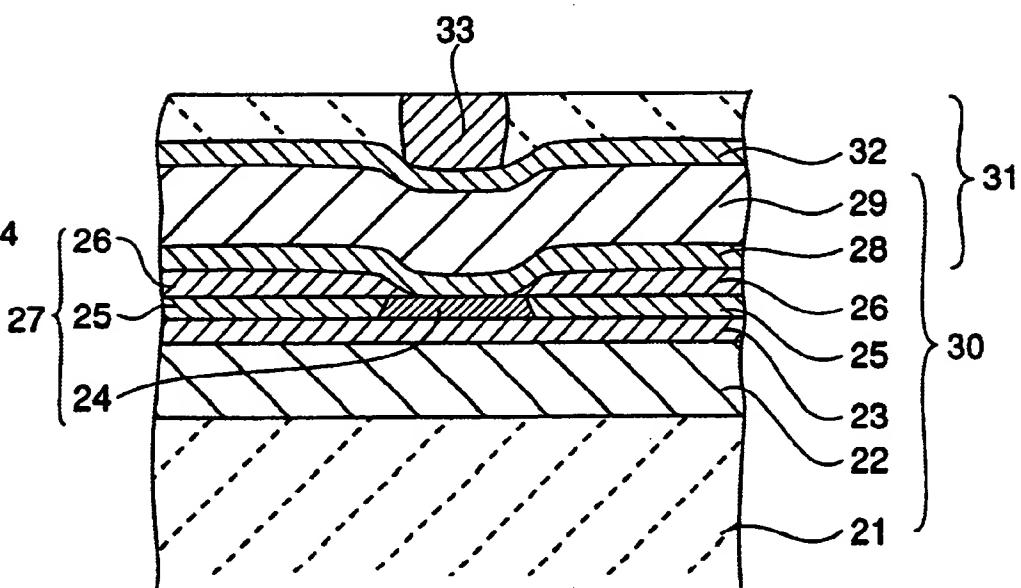
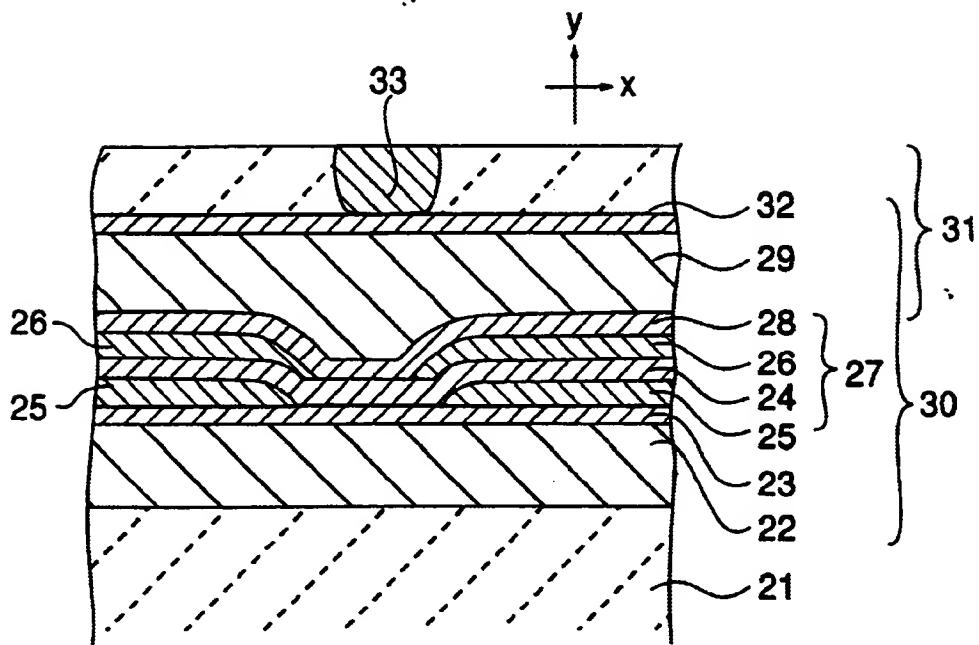


Fig.45



1020010723295 2023061

Fig.46

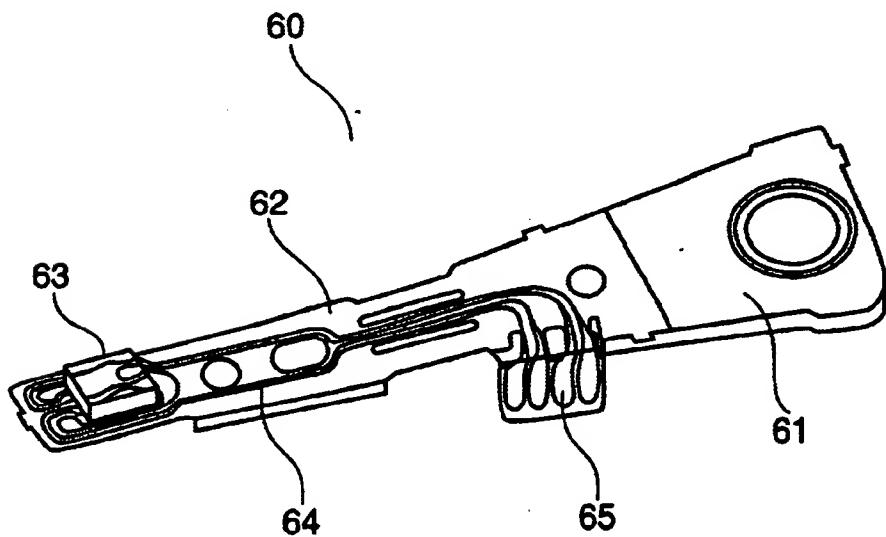
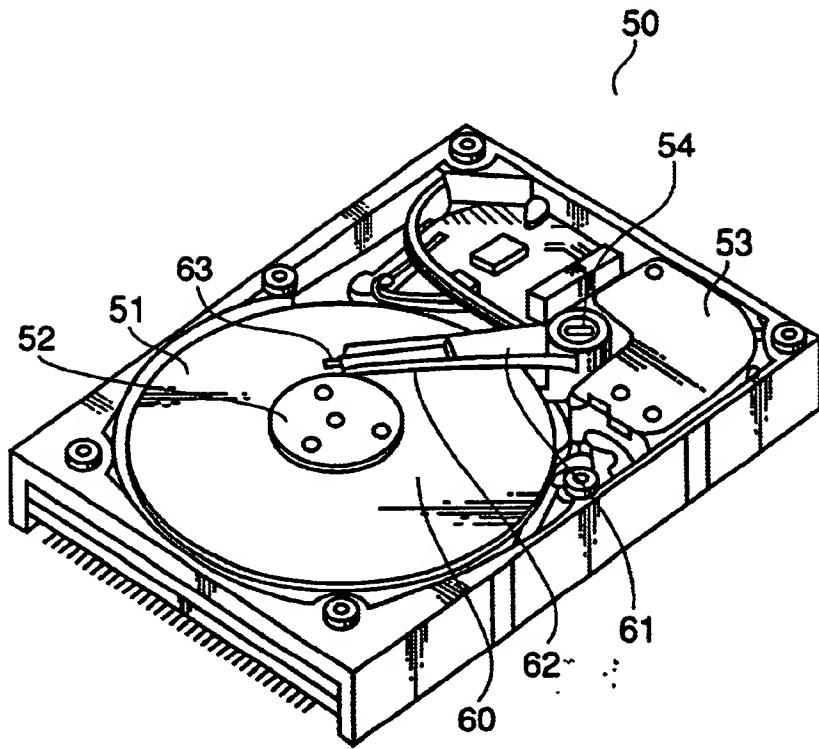


Fig.47.



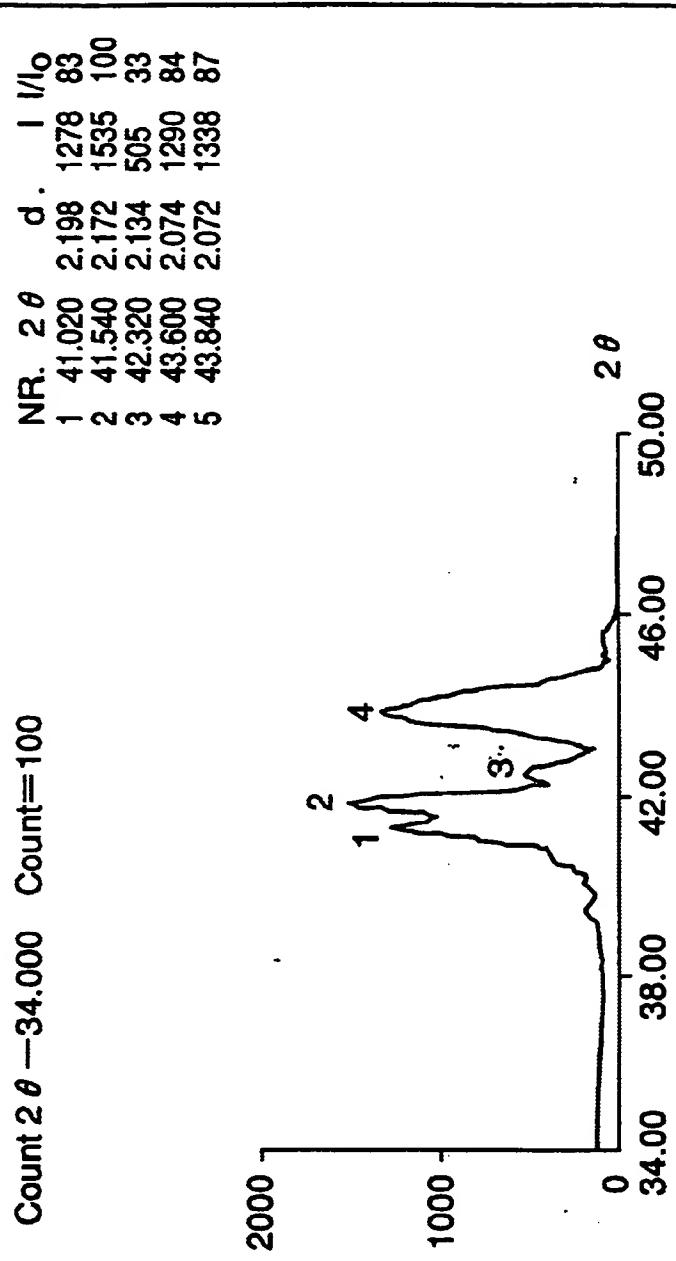
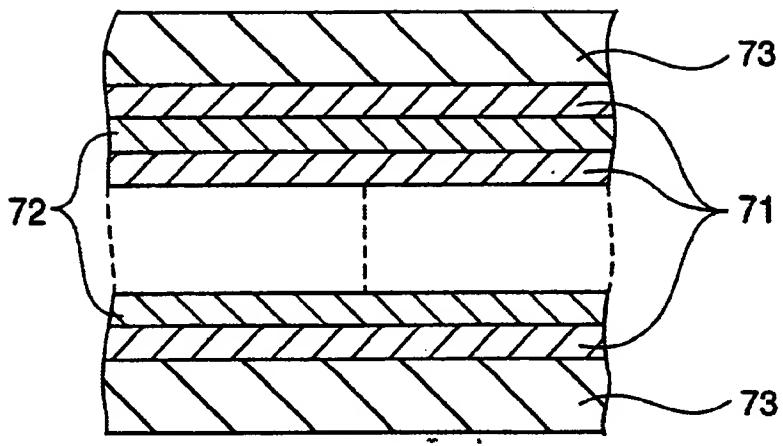


Fig.48

Fig.49



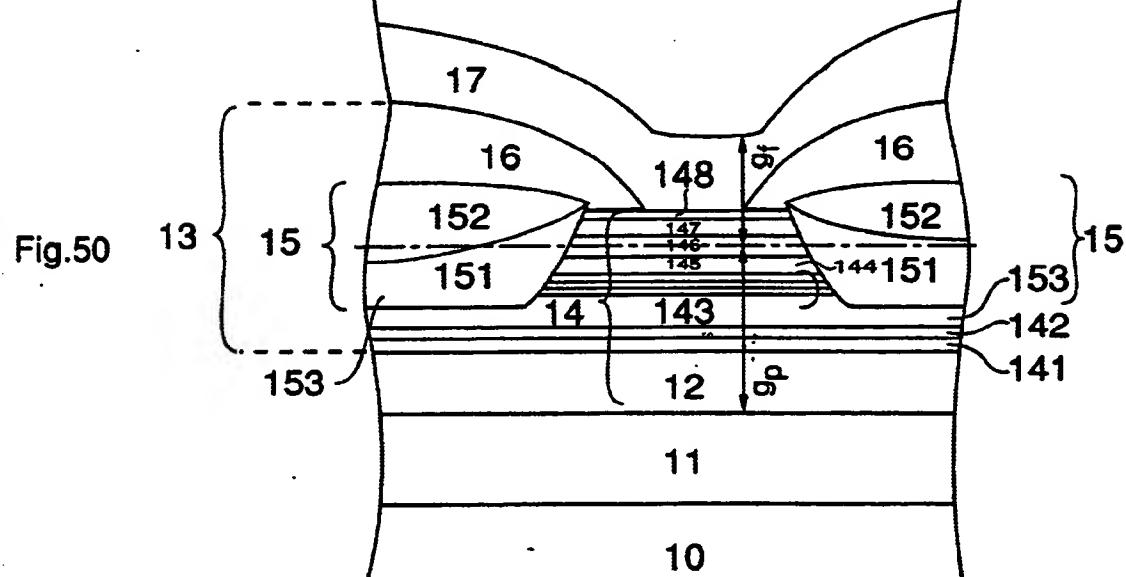


Fig.51

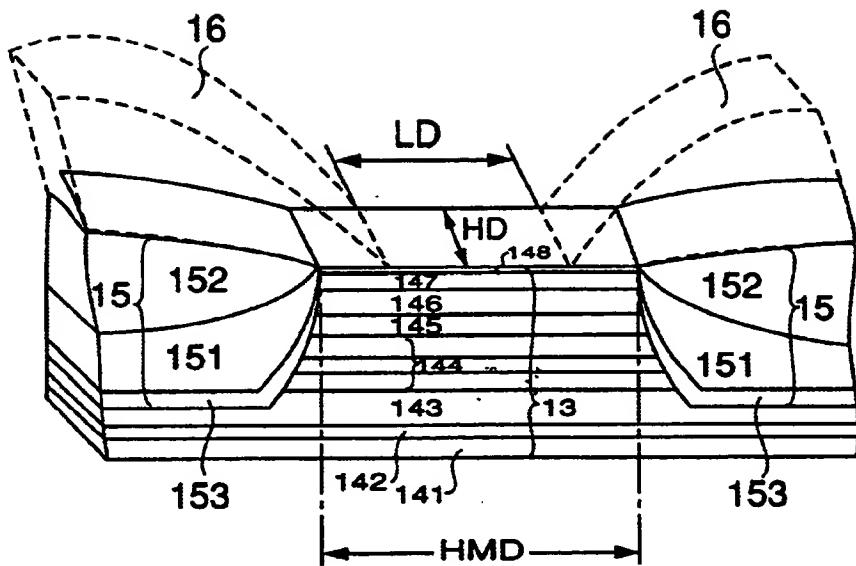


Fig.52

